

**Chemical &  
Engineering**

**NEWS**

April 21, 1980

**US**

**SCIENCE TIES VS. POWER POLITICS PAGE 37**

**USSR**

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## News of the Week

- **Chemical prices are being squeezed** from two directions—White House pressure for restraint and cost increases. **Page 6**
- **EPA urges U.S. chlorofluorocarbon production** be frozen at 1979 level to curtail depletion of stratospheric ozone. **Page 7**
- **Proposed merger of OCAW** with two other unions would boost membership to more than 650,000. **Page 7**
- **EEOC publishes guidelines** for evaluating complaints of sexual harassment in the workplace. **Page 7**
- **Survey of pollution incidents** in the U.S. lists natural resource losses attributed to toxic pollution. **Page 8**
- **Gene transplanted** into mouse bone marrow cells functions in vivo. **Page 8**

## Business

- **DOE demonstration project** may hold answer to cleanup controversy over West Valley, N.Y., nuclear waste facility. **Page 11**

## International

- **Essochem Europe strengthens its position** through purchase of LDPE operations, expansion of olefins capacity. **Page 14**

## Government

- **Acid rain discussion** at EPA-sponsored meeting yields controversy, possible EPA action under Clean Air Act. **Page 22**

- **Federal R&D budget** will lose only \$1 billion, about 3% of the original figure, if proposed cuts are made. **Page 23**

## Science

- **Analogs of synthetic sweetener aspartame** are under study to discover what determines its flavor. **Page 27**
- **Norris Award winner Ronald Breslow** philosophizes on the attractions of physical organic chemistry. **Page 28**

## Technology

- **Tests of underground coal gasification** using technology licensed from the Soviet Union are successful. **Page 33**
- **Direct contact heat exchange process** to extract energy from geothermal brine will be tried out in Imperial Valley. **Page 34**

## News Forum

- **Role of scientists** and scientific societies in issues involving political actions of foreign governments debated by Jeremy Stone and A. Frederick Spilhaus Jr. **Page 37**

## ACS News

- **Decline in Ph.D. chemist graduates halted** in 1979; B.S. chemist numbers stayed high; chem engineers gained markedly. **Page 58**
- **Totals of graduates** from ACS-approved schools, other statistics are contained in 1979 annual report of Committee on Professional Training. **Page 60**

adopts this course of action, Goodwin sees two to four years of litigation that "will stand as an obstacle to actions that could be taken that could produce results sooner."

Not only would regulations developed under section 111d be resisted in Illinois, Goodwin says, but, "virtually any regulatory action that is proposed to mitigate acid rain is likely to be perceived as having an adverse effect on either the coal industry or electric utilities or both," and would be strongly opposed by these interests. On the other hand, northeastern states, recipients of acid rain, have clamped down on their own polluting sources and are now seeking equity in a national imposition of uniform emissions standards for all states, including coal-producing and electricity-exporting states in the Midwest and Appalachia.

Nothing was more clearly delineated at the meeting than the dichotomy between the coal-producing states and the states receiving acid rain. Until the conflicts between these two groups are resolved, the acid rain problem cannot be tackled. Both groups called for federal leadership and guidance.

EPA is certain to sidestep this role by studying its options for the next six to 12 months. Unless, of course, it is prodded into action by the momen-

tum of bilateral treaty negotiations to get under way shortly.

As a good faith showing, EPA could enforce section 115, the international pollution abatement segment of the current law. Under this section, Canada could trigger a federal call for a revision in a bordering state's implementation plan to decrease emissions from sources within the state that are contributing to air pollution, including acid rain, in Canada.

Canada, on the receiving end of a great deal of U.S. sulfates and nitrogen oxides emissions, would like to see a bilateral air pollution treaty signed expeditiously. However, Raymond M. Robinson, the assistant deputy minister of Environment Canada, EPA's counterpart across the border, does not foresee the signing of a treaty until the U.S. reduces relevant emissions substantially.

Although Robinson tells C&EN that he sees implementation of section 111d as a promising option, the opposition he heard at the meeting from the coal-producing states made legislative changes to the Clean Air Act a probable first step toward a negotiated agreement. Because amendments to the act are not likely before 1981, an agreement with Canada on long-range air pollution is not likely before 1982.

*Lois Ember, Washington*

## Proposed R&D budget cut amounts to only 3%

President Carter's proposed changes in his 1981 federal budget confirm earlier reports that the effects on research and development funding would be slight (C&EN, April 7, page 4).

Overall, the proposed R&D budget would be reduced slightly more than \$1 billion from the originally pro-

posed January figure, or about 2.9%. The revised 1981 budget requests \$35 billion for R&D, an increase of about 11% from 1980.

The small percentage decrease was described by Frank Press, the President's science adviser and director of the Office of Science & Technology Policy, as demonstrating the Administration's philosophy that R&D is an important investment in the nation's future.

In proposing its reductions, the Administration was striving to allow some growth in existing R&D programs and to preserve a number of new programs that originally had been funded, Press says. As a result, almost all of the new initiatives would remain intact, but most would be delayed or would proceed at a slower pace.

Some of the larger projects that would be delayed include the industrial innovation initiatives program, cosponsored by the Commerce Department and the National Science Foundation; the ocean margin drilling project; and the joint government/industry cooperative automobile research program.

Funds for basic research would be

### Among hardest hit in R&D budget trimming are NASA and NSF

| \$ Millions  | Revised 1981    | % change from January budget | % change from revised 1980 budget |
|--------------|-----------------|------------------------------|-----------------------------------|
| Defense      | \$16,343        | -1.3%                        | 19.4%                             |
| NASA         | 5,398           | -3.9                         | 5.6                               |
| Energy       | 4,990           | -2.3                         | 2.1                               |
| NIH          | 3,270           | -2.5                         | 3.5                               |
| NSF          | 992             | -6.1                         | 10.6                              |
| USDA         | 778             | -1.0                         | 5.4                               |
| EPA          | 445             | 0                            | 7.2                               |
| Interior     | 411             | -1.0                         | -1.9                              |
| Commerce     | 371             | -2.1                         | 0                                 |
| NRC          | 228             | 0                            | 11.8                              |
| Other        | 1,856           | -15.0                        | 8.2                               |
| <b>TOTAL</b> | <b>\$35,082</b> | <b>-2.9%</b>                 | <b>11.0%</b>                      |

Note: Obligations. Source: Office of Science & Technology Policy



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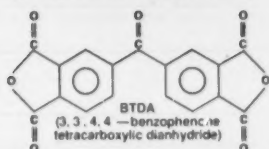
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April 21, 1980 C&EN 23

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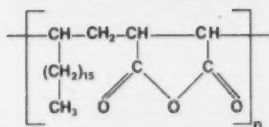


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cut slightly more than the overall R&D budget. Basic research is slated for \$4.9 billion in the revised 1981 budget, a reduction of \$194 million or about 3.8%. The reduction would permit basic research to grow 8.2% above the revised 1980 expenditures.

Programs faced with reductions have been chosen for some of the federal agencies. At the Department of Energy, for example, there would be reductions for magnetic fusion, basic energy research, and advanced coal gasification R&D. Cuts in spending also would delay construction of the ISABELLE high-energy physics project and the Solar Energy Research Institute facility. DOE's would be one of the smaller cuts in basic research with a reduction of only 1.2% to \$586 million.

At NSF, the proposed cuts would mean at least a one-year delay in the program to upgrade university research facilities. There also would be a phasedown of U.S.-U.S.S.R. cooperative research, and reduced funding for applied research projects.

The research grant program at the National Institutes of Health is slated for cuts of about \$35 million, and is not expected to hurt the Administration's plan to stabilize the number of research grant projects at NIH at about 5000.

Perhaps the agency most vulnerable to budget cuts has been the National Aeronautics & Space Administration, and it took a heavy blow in the current round of federal tight-fistedness. Its R&D budget would be cut \$219 million and its basic research funding 10.5%, actually pulling basic research funds below the revised 1980 level.

Although the Administration's commitment to the space shuttle's first flight within a year still stands, a number of NASA's programs would be slowed considerably because of the cuts. These include space science, aeronautics and space technology, and tracking and data application programs. In addition, launch of the international Solar Polar mission would be pushed to 1985 from 1983 and the investment for experiments aboard Spacelab IV would be rescheduled.

Of course, the proposed 1981 budget is just that—proposed. A number of Congressional authorization committees may further cut R&D funding before they approve a budget. The motivation for these changes may be just to show a bigger surplus for 1981 or to free more funds for other areas. With both houses already working on budget revisions of their own, it is certain only that the final result is still far from clear. □

# FIRST TIME OFFERED!!

## Priority Pollutant Analysis-Wastewater

A lecture-laboratory demonstration course jointly sponsored by the American Chemical Society and Battelle's Columbus Laboratories.

Emphasizing exact protocol methodology, this introductory course will benefit industrial chemists, academic faculty, analytical chemists, technicians, and others interested in the subject. The course provides participants with an understanding of required instrumentation, sample handling, QA/QC, and detailed discussions of the '600' methods for analyzing priority pollutants. The course will cover all 129 priority pollutant species, including organics (purgeables and extractables by GC, HPLC, and GC/MS), inorganics (metals by AA and ICAP; cyanide and phenol by SP; and asbestos by microscopy). Several limited laboratory demonstrations will be provided to illustrate key aspects of sample handling and analytical measurements.

**Date:** June 2-4, 1980

**Site:** Battelle's Columbus Laboratories, Columbus, Ohio

**Fees:** ACS members, \$375; Nonmembers, \$425

To register or to obtain a detailed brochure on the course, call or write:  
Education Dept.,  
American Chemical Society,  
1155 Sixteenth St., N.W.,  
Washington, D.C. 20036.  
202-872-4508.

## Number of grads changes little

The 1978-79 academic year brought at least a temporary halt in the long and serious decline in the number of new Ph.D. chemists graduating from U.S. universities. It also brought a continuation of a high plateau in B.S. chemist graduations. And it was marked by both a further spectacular gain in the number of new B.S. chemical engineers and continuation of an equally spectacular decline in new Ph.D. chemical engineers.

These are but a few of the trends that are apparent from the masses of data contained in the latest annual report of the American Chemical Society's Committee on Professional Training. (The full text of the report starts on page 60.)

This committee (CPT) has long played a vital role in improving and monitoring undergraduate chemistry training in this country. It is the mechanism by which ACS evaluates and approves undergraduate chemistry programs. The committee does not approve either graduate chemistry programs or chemical engineering programs. However, it collects data on both areas on an annual basis and it makes periodic reports on graduate chemistry education.

Schools carrying the undergraduate chemistry program on the CPT approved list, which numbered 551 at the end of 1979, account for about 90% of all B.S. chemistry degrees awarded in the U.S. They also account for more than 90% of M.S. chemistry degrees and for essentially all chemistry Ph.D.'s.

The total number of B.S. chemistry graduates, both certified and non-certified, from CPT-approved programs seems to be set at a high level and in a pattern of modest year-to-year growth. The 1978-79 total of 10,451 was a new high and it was up 1% from the 1977-78 level. This year the same group of programs expects a total of 10,539 bachelor graduates with majors in chemistry. This will mean that graduations from CPT-approved programs will have grown at an average annual rate of 1.5% since 1975-76. In the previous four years such graduations had grown at a 5.9% average annual rate.

## These schools had the most chemistry graduates, 1978-79

### Total B.S. graduates

|                                       |     |
|---------------------------------------|-----|
| 1. U of North Carolina, Chapel Hill   | 171 |
| 2. Indiana U                          | 137 |
| 3. U of Pittsburgh                    | 119 |
| 4. U of California, Los Angeles       | 111 |
| 5. U of South Florida                 | 108 |
| 6. U of Florida                       | 104 |
| 7. U of Maryland                      | 100 |
| 8. U of Miami                         | 92  |
| 9. Emory U                            | 84  |
| 10. U of Illinois, Urbana             | 82  |
| 11. Duke U                            | 80  |
| 12. Miami U                           | 79  |
| 13. U of California, San Diego        | 74  |
| 14. Auburn U                          | 71  |
| 15. U of Puerto Rico, Rio Piedras     | 65  |
| 16. U of Virginia                     | 62  |
| 17. Cornell U                         | 61  |
| 17. U of Michigan, Ann Arbor          | 61  |
| 19. Massachusetts Inst. of Technology | 60  |
| 20. California Polytechnic State U    | 59  |
| 20. City U of New York, Brooklyn C    | 59  |
| 20. U of Washington                   | 59  |
| 23. Northern Arizona U                | 57  |
| 23. U of Texas, Austin                | 56  |
| 25. U of Delaware                     | 55  |

### Certified B.S. graduates

|                                      |    |
|--------------------------------------|----|
| 1. U of California, San Diego        | 74 |
| 2. Cornell U                         | 61 |
| 2. U of Michigan, Ann Arbor          | 61 |
| 4. Massachusetts Inst. of Technology | 60 |
| 5. U of Texas, Austin                | 56 |
| 6. U of Pittsburgh                   | 52 |
| 7. Rutgers U, Rutgers C              | 47 |
| 8. U of California, Berkeley         | 44 |
| 9. Illinois State U                  | 40 |
| 10. U of North Carolina, Chapel Hill | 39 |
| 10. State U of New York, Albany      | 39 |
| 10. U of Washington                  | 39 |
| 13. U of Minnesota, Minneapolis      | 38 |
| 14. U of Delaware                    | 36 |
| 14. Georgia Inst. of Technology      | 35 |
| 16. U of California, Los Angeles     | 34 |
| 17. Rensselaer Polytechnic Inst.     | 32 |
| 18. Brigham Young U                  | 30 |
| 18. Case Western Reserve U           | 30 |
| 18. Manhattan C                      | 30 |
| 18. Rutgers U, Douglass C            | 30 |
| 22. U of Cincinnati                  | 29 |
| 22. Indiana U                        | 29 |
| 24. U of Illinois, Chicago Circle    | 28 |
| 24. Lehigh U                         | 28 |

### M.S. graduates

|                                       |    |
|---------------------------------------|----|
| 1. U of California, San Diego         | 39 |
| 2. U of Illinois, Urbana              | 36 |
| 2. Yale U                             | 36 |
| 4. Northwestern U                     | 29 |
| 5. Columbia U                         | 27 |
| 6. Ohio State U                       | 24 |
| 7. Harvard U                          | 22 |
| 7. Lawrence U                         | 22 |
| 7. Purdue U                           | 22 |
| 10. Cornell U                         | 21 |
| 11. U of California, Santa Barbara    | 19 |
| 12. U of California, Berkeley         | 17 |
| 12. U of Michigan, Ann Arbor          | 17 |
| 14. U of California, Los Angeles      | 16 |
| 14. U of Colorado, Boulder            | 16 |
| 14. U of Pittsburgh                   | 16 |
| 14. Wright State U                    | 16 |
| 18. Stevens Institute of Technology   | 15 |
| 18. Washington U                      | 15 |
| 18. U of Washington                   | 15 |
| 21. California State U, Long Beach    | 14 |
| 21. Eastern Michigan U                | 14 |
| 21. St. Joseph's U                    | 14 |
| 24. Pennsylvania State U              | 13 |
| 24. Rutgers U, Douglass C & Rutgers C | 13 |
| 24. Rutgers U, Newark C of Arts & Sci | 13 |
| 24. U of Southern California          | 13 |

### Ph.D. graduates

|                                       |    |
|---------------------------------------|----|
| 1. U of Illinois, Urbana              | 54 |
| 2. U of Wisconsin, Madison            | 49 |
| 3. U of California, Berkeley          | 41 |
| 4. Michigan State U                   | 38 |
| 4. Purdue U                           | 38 |
| 6. Northwestern U                     | 35 |
| 7. Cornell U                          | 32 |
| 8. U of California, Los Angeles       | 30 |
| 9. Ohio State U                       | 29 |
| 10. Massachusetts Inst. of Technology | 27 |
| 11. Stanford U                        | 25 |
| 12. California Inst. of Technology    | 23 |
| 12. U of Georgia                      | 23 |
| 14. Iowa State U of Sci & Tech        | 22 |
| 14. U of North Carolina, Chapel Hill  | 22 |
| 14. Pennsylvania State U              | 22 |
| 14. Princeton U                       | 22 |
| 18. Columbia U                        | 21 |
| 18. U of Maryland                     | 21 |
| 18. Texas A&M U                       | 21 |
| 21. Harvard U                         | 20 |
| 22. U of Chicago                      | 18 |
| 22. Indiana U                         | 18 |
| 24. U of Florida                      | 16 |
| 24. Howard U                          | 16 |
| 24. U of Massachusetts                | 16 |
| 24. U of Texas, Austin                | 16 |

Last year 42% of B.S. graduates from CPT-approved programs were certified, up from 41% for the three previous years, but still well down from the 51% level of 1968-69. Certified graduates have completed a curriculum specified by CPT. They are immediately eligible for membership in ACS and they are more likely, than are noncertified graduates, to stay in the chemical profession.

M.S. chemistry graduations showed no particular trend last year. The total of 1716 was between the totals for the two previous years and so continued the rather erratic pattern of recent years. However, Ph.D. graduates held steady at the 1532 level of 1977-78 and so brought at least a pause in the long, almost uninterrupted decline from the all-time high of 2145 in 1969-70.

The data on chemical engineering graduates in the CPT report are not complete, as chemical engineering departments are not required to report to the committee. However, the data available do reflect the sharp growth in new B.S. chemical engi-

neers. The data also confirm that this growth will continue this year. The 112 departments that reported 4977 graduates for 1978-79 expect no less than 5854 in 1979-80. This would be more than twice the 2873 graduates reported by 120 schools in 1974-75. The data also indicate that the decline in Ph.D. graduates has been even more severe in chemical engineering than it has been in chemistry. In 1969-70 108 schools reported 430 such graduates. Last year 107 schools reported just 237.

Last year's chemical engineering data indicate that the recent surge of women into chemical engineering is starting to show up in the form of graduations. Last year women B.S. chemical engineers numbered 862, 17.3% of the class. By contrast, in 1972-73, 90 women received B.S. chemical engineering degrees, only 2.8% of the class.

As it has for the six previous years, C&EN has analyzed the CPT report to compile a ranking of the largest producers of chemistry graduates. As it did in the previous five years, the University of North Carolina, Chapel

Hill, in 1978-79 produced the largest total of certified and noncertified B.S. chemists. In all, seven institutions each produced 100 or more B.S. graduates, up from five the previous year and from zero as recently as 1972-73.

For the fifth consecutive year, the University of California, San Diego, was the largest producer of certified B.S. chemists. The same school was also the largest producer of M.S. chemists, displacing Purdue University. And the University of Illinois, Urbana, was the primary producer of Ph.D. chemists for the sixth year in a row.

The rapid rise in the number of new B.S. chemical engineering graduates is reflected in the experience of Purdue University. Last year it was the largest producer with 159. It was also the largest producer in 1976-77 with just 81. The most M.S. chemical engineers, 44, last year came from Massachusetts Institute of Technology and the largest contributor to the dwindling total of Ph.D. chemical engineers was the University of California, Berkeley, with 12. □

## COMMENT

### Rededication to environmental progress

Tomorrow, April 22, is Earth Day 1980, marking the beginning of our second environmental decade. It is my sincere hope that members of ACS, on this occasion, will rededicate themselves to achieving another decade of environmental progress.

I was especially pleased to note that among the goals President Carter stated in his Earth Day 1980 proclamation was that the people of this planet be freed from the spread of toxic chemicals. Much public concern has been expressed recently about this and other problems involving chemicals.

Admittedly, there is cause for concern over problems related to chemicals. No technology is without its risks and dangers. Yet, the concerns over chemical problems and the environment are of long standing to ACS and its members. The society has a record of concern and action regarding environmental improvement of which it can be proud.

In 1967 the society inaugurated its monthly publication *Environmental Science & Technology* as an instrument for reports on aspects of the environment and its control by scientific, engineering, and political means. This magazine is read monthly by more than 18,000 people.

To further demonstrate its commitment to enhancing the quality of life, the society in 1979 established its Committee on Environmental Improvement. From this committee has come "Cleaning Our Environment," a massive study of environmental problems and recommended solutions first published in 1969. An updated and expanded edition was published in 1978. These studies offer a considerable number of recommendations on controlling nuclear and other hazardous wastes, pesticide use, control of air and water pollution, toxicology, and the importance and use of chemical analysis in environmental protection. It is unfortunate that many of our recommendations have not been pursued as vigorously as environmental conditions demand.

In 1973 one of the society's divisions, long concerned with the problems of pollution, evolved into the Division of Environmental Chemistry. Work in its area has expanded dramatically, and literally hundreds of research papers on environmental problems and their solutions are presented through the division at the society's two national meetings each year.

The decade just past also saw enactment of much needed environmental

legislation. Since 1973, through testimony before Congress and in numerous other public statements, ACS has strongly supported the concept of toxic substances control. With passage of the Toxic Substances Control Act in 1976, the society began working with the Environmental Protection Agency to develop regulations implementing the act. The society is pledged to do all it can to ensure that EPA's regulations have a strong scientific foundation and are credible to both the scientific community and the general public.

Chemical science has helped make life better, but with some consequences and costs that we are only now beginning to learn. In this light, chemistry has made some of the most agonizing choices necessary, and it has also made some of the most promising choices possible.

Like other scientists, chemists cannot always know the future implications of what they learn and do. The opportunities for benefiting society are infinite. I hope you will join me in pledging that this is what we intend to do—benefit society while minimizing any possible damage to our environment.

James D. D'Ianni  
ACS president

# ACS Committee on Professional Training, 1979 Annual Report

The number of baccalaureate graduates in chemistry from schools whose undergraduate chemistry programs are approved by ACS rose 1% in 1978-79 from the previous year. The number of master's degrees from these departments decreased 5% from 1978, and the number of Ph.D. degrees was the same as 1977-78.

The percentage of baccalaureate graduates certified to ACS rose to 42%, up slightly from the 41% reported for the previous three years. (Certified graduates are those who have completed the curriculum specified by CPT and are eligible for full membership in ACS; noncertified graduates may become associate members of ACS upon graduation and full members after three years of professional experience or a higher degree in a chemical science.)

Total numbers of bachelor's degrees (certified and noncertified), master's degrees, and Ph.D. degrees awarded in 1978-79 by departments whose chemistry programs are ACS-approved are listed by institution in the large table at the end of this report and are summarized in the two smaller tables. These tables also include numbers of chemical engineering graduates from institutions whose programs are accredited by the American Institute of Chemical Engineers and the Engineers Council for Professional Development. (Note: These departments are not required to report their data to CPT, so the number of departments included in this listing varies from year to year.)

It is interesting to note that the number of bachelor's degrees in chemical engineering from the 112 AIChE-ECPD-accredited departments that reported in 1979 increased 18% from the total reported by 119 departments the previous year and that these 112 departments reported an expected further increase of 18% in

## Summary of data from approved programs, 1975-79

|                              | Bachelors         |                   |                     |                         | Masters           |           | Doctorates        |           |
|------------------------------|-------------------|-------------------|---------------------|-------------------------|-------------------|-----------|-------------------|-----------|
|                              | Number of schools | Graduates (total) | Certified graduates | Non-certified graduates | Number of schools | Graduates | Number of schools | Graduates |
| <b>CHEMISTRY</b>             |                   |                   |                     |                         |                   |           |                   |           |
| 1975                         | 526               | 9,084             | 3897                | 5187                    | 319               | 1814      | 189               | 1781      |
| 1976                         | 528               | 9,916             | 4103                | 5813                    | 322               | 1676      | 189               | 1622      |
| 1977                         | 534               | 10,207            | 4219                | 5988                    | 321               | 1688      | 189               | 1563      |
| 1978                         | 547               | 10,350            | 4286                | 6065                    | 323               | 1798      | 189               | 1532      |
| 1979                         | 551               | 10,451            | 4424                | 6027                    | 323               | 1716      | 188               | 1532      |
| <b>CHEMICAL ENGINEERING*</b> |                   |                   |                     |                         |                   |           |                   |           |
| 1975                         | 120               | —                 | 2873                | —                       | 117               | 1012      | 105               | 351       |
| 1976                         | 120               | —                 | 2920                | —                       | 108               | 1001      | 101               | 320       |
| 1977                         | 120               | —                 | 3282                | —                       | 115               | 1095      | 103               | 298       |
| 1978                         | 119               | —                 | 4225                | —                       | 114               | 1109      | 98                | 251       |
| 1979                         | 112               | —                 | 4977                | —                       | 107               | 951       | 92                | 237       |

\* Chemical engineering departments are not required to report their data to CPT, so the number of departments included in this category varies from year to year. Note: Bachelor's degree projections for 1980: 551 chemistry departments report that they expect a total of 10,539 bachelor graduates with majors in chemistry during the 1979-80 academic year, and 112 chemical engineering departments report that they expect a total of 5854 bachelor graduates with majors in chemical engineering.

1980. Over the five-year period from 1975 to 1979, the number of reported bachelor's degree graduates in chemical engineering from these schools has increased 73%. At the graduate level, the number of chemical engineering master's degrees reported in 1979 decreased 14% from the year before, and the number of Ph.D. degrees reported continued to decline, down 6% from 1978.

As part of the committee's approval activities, programs at all ACS-approved departments are normally re-evaluated at five-year intervals. There were 553 colleges and universities on the approved list at the end of 1979, and the committee studied the chemistry programs at 153 of them during the year. Each involved a review of extensive documentary materials submitted by the department head describing the current status of the program. During 1979, six chemistry programs were newly approved by the committee, two approved programs were put on probation, three were continued on probation, and two were removed from probation. No departments were removed from the approved list.

The 1979 edition of the Directory of Graduate Research, a listing of Ph.D.-degree-granting departments of chemistry, chemical engineering, biochemistry, and pharmaceutical/medicinal chemistry in the U.S. and Canada, was published in October. Production was again handled through a computerized process utilizing the data bank and computer facilities of Chemical Abstracts Service. The amount of information included in this edition of the directory, a biennial publication, again in-

creased about 11%, as it had for the previous two editions, although the number of departments included (528) increased only 1.5% from the previous edition. Copies of the 1979 edition are available from ACS for \$30 each.

The committee is involved in a study of the feasibility of preparing a concordance of faculty research interests by using the data in the Directory of Graduate Research. In addition to a printed version of the concordance, the committee also is looking into the possibility of constructing a tape of these data that would be available through on-line access to computer-readable files.

In response to a request from the ACS Division of Analytical Chemistry, the committee revised its section on analytical chemistry requirements in the 1977 revision of the criteria for ACS-approved programs. It was the feeling of the committee that the omission of the material was an oversight in the wording and that the addition represented no substantive change in CPT's actual practice.

Two members of the AIChE Education & Accreditation Committee

## Summary of totals from 1979 reports from approved programs

|                             | Schools reporting | Men  | Women | Total  |
|-----------------------------|-------------------|------|-------|--------|
| <b>CHEMISTRY</b>            |                   |      |       |        |
| Bachelors, total            | 551               | 7652 | 2789  | 10,451 |
| Certified                   |                   | 3317 | 1107  | 4,424  |
| Noncertified                |                   | 4336 | 1691  | 6,027  |
| Masters                     | 323               | 1268 | 448   | 1,716  |
| Doctorates                  | 188               | 1289 | 243   | 1,532  |
| <b>CHEMICAL ENGINEERING</b> |                   |      |       |        |
| Bachelors, certified        | 112               | 4115 | 862   | 4,977  |
| Masters                     | 107               | 879  | 72    | 951    |
| Doctorates                  | 92                | 233  | 4     | 237    |

## Committee members, 1979

H. S. Mosher, *chairman*

|                |                |
|----------------|----------------|
| J. A. Campbell | H. A. Laitinen |
| E. L. Eliel    | J. H. Lunsford |
| P. A. Figueras | P. G. Lykos    |
| H. B. Gray     | E. M. Pearce   |
| D. E. Jones    | M. B. Robin    |
|                | J. P. Segrest  |

B. R. Blaser, *secretary*

(CPT's counterpart in AIChE) met with the committee to discuss the concerns of AIChE in regard to the lessening amount of chemistry in the chemical engineering curriculum and the lack of industrial chemistry and chemical engineering in the chemistry curriculum. It was suggested that a joint AIChE-ACS group be set up to define the advanced chemistry subjects essential to chemical engineering and also those important for chemists entering industry. As a result of a recommendation by CPT to the ACS experimental Education Commission, three ACS representa-

tives have been appointed to this joint task force.

The ACS Council at its September meeting voted in favor of amending the ACS bylaws to include a definition of CPT's accrediting function for ACS. As reported previously, the Council on Postsecondary Accreditation (COPA), the national non-profit organization whose major purpose is to support, coordinate, and improve all nongovernment accrediting at the postsecondary level in the U.S., had specified that CPT, in order to continue to be recognized by COPA, show an improved status in

ACS's corporate structure. The committee agreed to document for COPA its recognition process for program approval (in lieu of accreditation) to serve as a model for organizations that desire recognition of less elaborate and costly methods of evaluating programs in their fields.

The terms of J. Arthur Campbell, Edward S. Lewis, Harry B. Gray, and Melvin B. Robin expired at the end of 1978. Campbell, Gray, and Robin were reappointed for three-year terms. Ernest M. Eliel and Herbert A. Laitinen received new appointments.

## Chemical and chemical engineering degrees awarded by approved schools, 1978-79

|                                  | CHEMISTRY            |    |      |       | CHEMICAL ENGINEERING |   |      |       |   | CHEMISTRY                             |    |      |       | CHEMICAL ENGINEERING |     |      |       |   |
|----------------------------------|----------------------|----|------|-------|----------------------|---|------|-------|---|---------------------------------------|----|------|-------|----------------------|-----|------|-------|---|
|                                  | Bachelors, certified |    | M.S. | Ph.D. | B.S.                 |   | M.S. | Ph.D. |   | Bachelors, certified                  |    | M.S. | Ph.D. | B.S.                 |     | M.S. | Ph.D. |   |
|                                  | Yes                  | No |      |       |                      |   |      |       |   | Yes                                   | No |      |       |                      |     |      |       |   |
| Ablene Christian U               | 4                    | 3  | 2    | —     | —                    | — | —    | —     | — | California State U                    |    |      |       |                      |     |      |       |   |
| Adelphi U                        | 2                    | 7  | 0    | 4     | —                    | — | —    | —     | — | Chico                                 | 4  | 7    | —     | —                    | —   | —    | —     | — |
| Agnes Scott C                    | 2                    | 0  | —    | —     | —                    | — | —    | —     | — | Dominguez Hills                       | 4  | 3    | —     | —                    | —   | —    | —     | — |
| Akron, U of                      | 17                   | 0  | 3    | 3     | 25                   | 2 | 2    | —     | — | Fresno                                | 4  | 9    | 5     | —                    | —   | —    | —     | — |
| Alabama, U of                    |                      |    |      |       |                      |   |      |       |   | Fullerton                             | 14 | 12   | 1     | —                    | —   | —    | —     | — |
| University                       | 5                    | 30 | 2    | 3     | 26                   | 8 | 0    | —     | — | Hayward                               | 16 | 29   | 2     | —                    | —   | —    | —     | — |
| Birmingham                       | 3                    | 14 | 1    | 2     | —                    | — | —    | —     | — | Long Beach                            | 10 | 26   | 14    | —                    | —   | —    | —     | — |
| Huntsville                       | 2                    | 5  | 1    | —     | —                    | — | —    | —     | — | Los Angeles                           | 14 | 0    | 1     | —                    | —   | —    | —     | — |
| Alaska, U of                     | 4                    | 0  | 1    | —     | —                    | — | —    | —     | — | Northridge                            | 5  | 10   | 1     | —                    | —   | —    | —     | — |
| Albion C                         | 7                    | 10 | —    | —     | —                    | — | —    | —     | — | Sacramento                            | 7  | 4    | 4     | —                    | —   | —    | —     | — |
| Albright C                       | 6                    | 20 | —    | —     | —                    | — | —    | —     | — | California, U of                      |    |      |       |                      |     |      |       |   |
| Alfred U                         | 6                    | 0  | —    | —     | —                    | — | —    | —     | — | Berkeley                              | 44 | 0    | 17    | 41                   | 92  | 33   | 12    | — |
| Allegheny C                      | 3                    | 30 | —    | —     | —                    | — | —    | —     | — | Davis                                 | 10 | 7    | 3     | 14                   | 50  | 1    | 0     | — |
| Aima C                           | 1                    | 10 | —    | —     | —                    | — | —    | —     | — | Irvine                                | 6  | 44   | 6     | 9                    | —   | —    | —     | — |
| American U                       | 7                    | 3  | 3    | 3     | —                    | — | —    | —     | — | Los Angeles                           | 34 | 77   | 16    | 30                   | —   | —    | —     | — |
| Amherst C                        | 1                    | 2  | —    | 0     | —                    | — | —    | —     | — | Riverside                             | 16 | 1    | 12    | 6                    | —   | —    | —     | — |
| Andrews U                        | 5                    | 6  | —    | —     | —                    | — | —    | —     | — | San Diego                             | 74 | 0    | 39    | 13                   | —   | —    | —     | — |
| Antioch C                        | 6                    | 2  | —    | —     | —                    | — | —    | —     | — | Santa Barbara                         | 23 | 0    | 19    | 10                   | 28  | 5    | 0     | — |
| Appalachian State U <sup>a</sup> | 1                    | 5  | 0    | —     | —                    | — | —    | —     | — | Santa Cruz                            | 18 | 1    | 5     | 10                   | —   | —    | —     | — |
| Arizona State U                  | 27                   | 17 | 3    | 9     | 27                   | 4 | 0    | —     | — | Calvin C                              | 6  | 41   | —     | —                    | —   | —    | —     | — |
| Arizona, U of                    | 27                   | 20 | 2    | 13    | 34                   | 4 | 0    | —     | — | Canisius C                            | 0  | 5    | —     | —                    | —   | —    | —     | — |
| Arkansas, U of                   |                      |    |      |       |                      |   |      |       |   | Capital U                             | 1  | 5    | —     | —                    | —   | —    | —     | — |
| Fayetteville                     | 6                    | 19 | 3    | 7     | 31                   | 4 | 0    | —     | — | Carleton C                            | 4  | 28   | —     | —                    | —   | —    | —     | — |
| Little Rock                      | 10                   | 6  | 1    | —     | —                    | — | —    | —     | — | Carnegie-Mellon U                     | 24 | 1    | 4     | 5                    | (e) | —    | —     | — |
| Ashland C                        | 2                    | 2  | —    | —     | —                    | — | —    | —     | — | Carroll C                             | 2  | 9    | —     | —                    | —   | —    | —     | — |
| Auburn U                         | 9                    | 62 | 5    | 3     | 46                   | 7 | 1    | —     | — | Carthage C                            | 2  | 6    | —     | —                    | —   | —    | —     | — |
| Augsburg C                       | 3                    | 9  | —    | —     | —                    | — | —    | —     | — | Case Western Reserve U                | 30 | 7    | 1     | 8                    | 25  | 12   | 1     | — |
| Augustana C, Rock Island, Ill.   | 3                    | 14 | —    | —     | —                    | — | —    | —     | — | Catholic U of America                 | 8  | 1    | 2     | 3                    | 8   | 3    | 1     | — |
| Augustana C, Sioux Falls, S.D.   | 2                    | 9  | —    | —     | —                    | — | —    | —     | — | Centenary C of Louisiana              | 0  | 5    | —     | —                    | —   | —    | —     | — |
| Austin C                         | 0                    | 9  | —    | —     | —                    | — | —    | —     | — | Central C                             | 0  | 5    | —     | —                    | —   | —    | —     | — |
| Baldwin-Wallace C                | 2                    | 5  | —    | —     | —                    | — | —    | —     | — | Central Connecticut State C           | 9  | 3    | 3     | —                    | —   | —    | —     | — |
| Ball State U                     | 6                    | 2  | 5    | —     | —                    | — | —    | —     | — | Central Florida, U of                 | 12 | 0    | 4     | —                    | —   | —    | —     | — |
| Barnard C                        | 0                    | 21 | —    | —     | —                    | — | —    | —     | — | Central Michigan U                    | 5  | 11   | 7     | —                    | —   | —    | —     | — |
| Bates C                          | 5                    | 9  | —    | —     | —                    | — | —    | —     | — | Central State U                       | 4  | 2    | —     | —                    | —   | —    | —     | — |
| Baylor U                         | 15                   | 14 | 3    | 5     | —                    | — | —    | —     | — | Charleston, C of <sup>a</sup>         | 2  | 0    | —     | —                    | —   | —    | —     | — |
| Beloit C                         | 0                    | 10 | —    | —     | —                    | — | —    | —     | — | Chatham C                             | 7  | 22   | 11    | 18                   | —   | —    | —     | — |
| Bemidji State U                  | 3                    | 1  | —    | —     | —                    | — | —    | —     | — | Chicago, U of                         | 29 | 0    | 8     | 10                   | 48  | 15   | 1     | — |
| Birmingham-Southern C            | 3                    | 15 | —    | —     | —                    | — | —    | —     | — | Cincinnati, U of                      | 1  | 14   | —     | —                    | —   | —    | —     | — |
| Bloomsburg State C               | 4                    | 2  | —    | —     | —                    | — | —    | —     | — | Citadel, The                          | —  | —    | —     | 11                   | —   | —    | —     | — |
| Boston C                         | 13                   | 13 | 5    | 1     | —                    | — | —    | —     | — | City U of New York                    | —  | —    | —     | —                    | —   | —    | —     | — |
| Boston U                         | 7                    | 20 | 7    | 6     | —                    | — | —    | —     | — | Brooklyn C                            | 5  | 54   | 6     | —                    | —   | —    | —     | — |
| Bowdoin C                        | 0                    | 31 | —    | —     | —                    | — | —    | —     | — | City C                                | 1  | 17   | 1     | —                    | 30  | 4    | 1     | — |
| Bowling Green State U            | 6                    | 28 | 4    | —     | —                    | — | —    | —     | — | Herbert H. Lehman C                   | 11 | 0    | —     | —                    | —   | —    | —     | — |
| Bradley U                        | 3                    | 5  | 0    | —     | —                    | — | —    | —     | — | Hunter C                              | 7  | 14   | 1     | —                    | —   | —    | —     | — |
| Brandeis U                       | 1                    | 17 | 6    | 9     | —                    | — | —    | —     | — | Queens C                              | 15 | 21   | 3     | —                    | —   | —    | —     | — |
| Bridgeport, U of                 | 6                    | 0  | 4    | —     | —                    | — | —    | —     | — | Clarion State C                       | 6  | 2    | —     | —                    | —   | —    | —     | — |
| Bridgewater State C              | 5                    | 4  | 3    | —     | —                    | — | —    | —     | — | Clark U                               | 14 | 0    | 4     | 2                    | —   | —    | —     | — |
| Brigham Young U                  | 30                   | 9  | 4    | 4     | 32                   | 2 | 2    | —     | — | Clarkson C of Technology              | 19 | 0    | 11    | 2                    | (e) | —    | —     | — |
| Brown U                          | 2                    | 37 | 1    | 14    | —                    | — | —    | —     | — | Clemson U                             | 11 | 2    | 2     | 3                    | 36  | 2    | 1     | — |
| Bryn Mawr C                      | 11                   | 0  | 0    | 3     | —                    | — | —    | —     | — | Cleveland State U                     | 23 | 0    | 11    | 3                    | 71  | 17   | —     | — |
| Bucknell U                       | 18                   | 10 | 4    | —     | 25                   | 5 | —    | —     | — | Coe C                                 | 1  | 4    | —     | —                    | —   | —    | —     | — |
| Butler U                         | 4                    | 12 | 3    | —     | —                    | — | —    | —     | — | Colby C                               | 1  | 6    | —     | —                    | —   | —    | —     | — |
| California Institute of Tech     | 22                   | 0  | 5    | 23    | 12                   | 5 | 8    | —     | — | Colgate U                             | 0  | 20   | —     | —                    | —   | —    | —     | — |
| California Polytechnic State U   | 20                   | 39 | 1    | —     | —                    | — | —    | —     | — | Colorado C                            | 6  | 5    | —     | —                    | —   | —    | —     | — |
| California State C               | —                    | —  | —    | —     | —                    | — | —    | —     | — | Colorado School of Mines & Technology | 4  | 0    | 7     | 2                    | 50  | 7    | 6     | — |
| Bakersfield                      | 6                    | 1  | —    | —     | —                    | — | —    | —     | — | Colorado State U                      | 9  | 12   | 4     | 13                   | —   | —    | —     | — |
| San Bernardino                   | 1                    | 7  | —    | —     | —                    | — | —    | —     | — | Colorado, U of                        |    |      |       |                      |     |      |       |   |
| Stanislaus                       | 3                    | 1  | —    | —     | —                    | — | —    | —     | — | Boulder                               | 26 | 22   | 16    | 12                   | 46  | 9    | 1     | — |
| California State Polytechnic U   | 11                   | 0  | 4    | —     | (e)                  | — | —    | —     | — |                                       |    |      |       |                      |     |      |       |   |

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|                            | CHEMISTRY            |    |      |       | CHEMICAL ENGINEERING |    |      |       |   | CHEMISTRY                 |     |      |       | CHEMICAL ENGINEERING |    |      |       |   |
|----------------------------|----------------------|----|------|-------|----------------------|----|------|-------|---|---------------------------|-----|------|-------|----------------------|----|------|-------|---|
|                            | Bachelors, certified |    | M.S. | Ph.D. | B.S.                 |    | M.S. | Ph.D. |   | Bachelors, certified      |     | M.S. | Ph.D. | B.S.                 |    | M.S. | Ph.D. |   |
|                            | Yes                  | No |      |       |                      |    |      |       |   | Yes                       | No  |      |       |                      |    |      |       |   |
| Denver                     | 2                    | 16 | 3    | —     | —                    | —  | —    | —     | — | 4                         | 7   | —    | —     | —                    | —  | —    | —     | — |
| Columbia U                 | 10                   | 0  | 27   | 21    | 59                   | 26 | 2    | —     | — | 0                         | 4   | 1    | —     | —                    | —  | —    | —     | — |
| Concordia C                | 5                    | 7  | —    | —     | —                    | —  | —    | —     | — | 6                         | 4   | 5    | 1     | 14                   | 12 | 1    | —     | — |
| Connecticut, U of          | 21                   | 21 | 6    | 6     | 52                   | 5  | 1    | —     | — | 21                        | 0   | —    | —     | —                    | —  | —    | —     | — |
| Cooper Union <sup>b</sup>  | —                    | —  | —    | —     | (e)                  | —  | —    | —     | — | —                         | —   | —    | —     | —                    | —  | —    | —     | — |
| Cornell C                  | 0                    | 11 | —    | —     | —                    | —  | —    | —     | — | 16                        | 0   | 2    | 2     | 41                   | 17 | 6    | —     | — |
| Cornell U                  | 61                   | 0  | 21   | 32    | 74                   | 12 | 3    | —     | — | 40                        | 0   | 7    | —     | —                    | —  | —    | —     | — |
| Dartmouth C                | 0                    | 35 | 1    | 2     | —                    | —  | —    | —     | — | —                         | —   | —    | —     | —                    | —  | —    | —     | — |
| David Lipscomb C           | 3                    | 24 | —    | —     | —                    | —  | —    | —     | — | 28                        | 26  | 12   | 7     | 27                   | 7  | 1    | —     | — |
| Davidson C                 | 10                   | 4  | —    | —     | —                    | —  | —    | —     | — | 18                        | 64  | 36   | 54    | 102                  | 13 | 9    | —     | — |
| Dayton, U of               | 10                   | 9  | 4    | —     | 39                   | 0  | —    | —     | — | 0                         | 7   | —    | —     | —                    | —  | —    | —     | — |
| Delaware State C           | 1                    | 5  | —    | —     | —                    | —  | —    | —     | — | 2                         | 6   | 0    | —     | —                    | —  | —    | —     | — |
| Delaware, U of             | 35                   | 20 | 3    | 4     | 61                   | 19 | 7    | —     | — | 29                        | 108 | 7    | 18    | —                    | —  | —    | —     | — |
| Delaware Valley C of       | —                    | —  | —    | —     | —                    | —  | —    | —     | — | 14                        | 7   | 2    | —     | —                    | —  | —    | —     | — |
| Science & Agriculture      | 4                    | 0  | —    | —     | —                    | —  | —    | —     | — | 2                         | 5   | —    | —     | —                    | —  | —    | —     | — |
| Denison U                  | 2                    | 14 | —    | —     | —                    | —  | —    | —     | — | Indiana U                 | 7   | 2    | 12    | 9                    | 22 | 2    | 1     | — |
| Denver, U of               | 3                    | 5  | 5    | 0     | —                    | —  | —    | —     | — | Ithaca C                  | 3   | 4    | —     | —                    | —  | —    | —     | — |
| De Paul U                  | 0                    | 8  | 6    | —     | —                    | —  | —    | —     | — | Jackson State U           | 8   | 0    | 1     | —                    | —  | —    | —     | — |
| DePauw U                   | 2                    | 12 | 0    | —     | —                    | —  | —    | —     | — | John Carroll U            | 12  | 23   | 3     | —                    | —  | —    | —     | — |
| Detroit, U of              | 8                    | 4  | 2    | 3     | (e)                  | —  | —    | —     | — | Johns Hopkins U           | 10  | 1    | 9     | 7                    | —  | —    | —     | — |
| Dickinson C                | 1                    | 11 | —    | —     | —                    | —  | —    | —     | — | Juniata C                 | 7   | 9    | —     | —                    | —  | —    | —     | — |
| Drake U                    | 2                    | 3  | 0    | —     | —                    | —  | —    | —     | — | Kalamazoo C               | 7   | 18   | —     | —                    | —  | —    | —     | — |
| Drew U                     | 2                    | 6  | —    | —     | —                    | —  | —    | —     | — | Kansas State U            | 5   | 2    | 6     | 3                    | 25 | 5    | 1     | — |
| Drexel U                   | 13                   | 2  | 9    | 1     | 42                   | 5  | 0    | —     | — | Kansas, U of              | 16  | 22   | 7     | 7                    | 53 | 3    | 0     | — |
| Duke U                     | 14                   | 66 | 2    | 14    | —                    | —  | —    | —     | — | Kearney State C           | 0   | 5    | —     | —                    | —  | —    | —     | — |
| Duquesne U                 | 5                    | 3  | 9    | 0     | —                    | —  | —    | —     | — | Kent State U              | 8   | 10   | 2     | 4                    | —  | —    | —     | — |
| Earlham C                  | 1                    | 6  | —    | —     | —                    | —  | —    | —     | — | Kentucky, U of            | 8   | 6    | 11    | 1                    | 34 | 7    | 2     | — |
| East Carolina U            | 5                    | 8  | 2    | —     | —                    | —  | —    | —     | — | Kenyon C                  | 7   | 0    | —     | —                    | —  | —    | —     | — |
| East Stroudsburg State C   | 3                    | 14 | —    | —     | —                    | —  | —    | —     | — | King's C                  | 5   | 0    | —     | —                    | —  | —    | —     | — |
| East Tennessee State U     | 4                    | 2  | 2    | —     | —                    | —  | —    | —     | — | Knox C                    | 3   | 20   | —     | —                    | —  | —    | —     | — |
| East Texas State U         | 3                    | 9  | 8    | —     | —                    | —  | —    | —     | — | Lafayette C               | 5   | 10   | —     | —                    | 23 | —    | —     | — |
| Eastern Illinois U         | 12                   | 2  | 3    | —     | —                    | —  | —    | —     | — | Lake Forest C             | 1   | 11   | —     | —                    | —  | —    | —     | — |
| Eastern Kentucky U         | 1                    | 7  | 1    | —     | —                    | —  | —    | —     | — | Lamar U                   | 10  | 3    | 1     | —                    | 27 | 4    | 1     | — |
| Eastern Michigan U         | 7                    | 25 | 14   | —     | —                    | —  | —    | —     | — | LaSalle C                 | 6   | 3    | —     | —                    | —  | —    | —     | — |
| Elizabethtown C            | 4                    | 21 | —    | —     | —                    | —  | —    | —     | — | Lawrence U                | 9   | 3    | 22    | 12                   | —  | —    | —     | — |
| Elmhurst C                 | 1                    | 7  | —    | —     | —                    | —  | —    | —     | — | Lebanon Valley C          | 9   | 2    | —     | —                    | —  | —    | —     | — |
| Emmanuel C                 | 0                    | 3  | —    | —     | —                    | —  | —    | —     | — | Lehigh U                  | 28  | 0    | 8     | 9                    | 90 | 22   | 9     | — |
| Emory U                    | 5                    | 79 | 12   | 4     | —                    | —  | —    | —     | — | Le Moyne C                | 10  | 0    | —     | —                    | —  | —    | —     | — |
| Emporia State U            | 2                    | 8  | 3    | —     | —                    | —  | —    | —     | — | Lincoln U                 | 0   | 3    | —     | —                    | —  | —    | —     | — |
| Evansville, U of           | 2                    | 9  | —    | —     | —                    | —  | —    | —     | — | Long Island U             | —   | —    | —     | —                    | —  | —    | —     | — |
| Fairfield U                | 11                   | 6  | —    | —     | —                    | —  | —    | —     | — | Brooklyn Center—Conolly C | 3   | 5    | 7     | —                    | —  | —    | —     | — |
| Fairleigh Dickinson U      | —                    | —  | —    | —     | —                    | —  | —    | —     | — | C. W. Post C              | 8   | 1    | —     | —                    | —  | —    | —     | — |
| Rutherford                 | 4                    | 0  | 7    | —     | —                    | —  | —    | —     | — | Loras C                   | 2   | 5    | —     | —                    | —  | —    | —     | — |
| Teaneck                    | 27                   | 0  | 4    | —     | —                    | —  | —    | —     | — | Louisiana State U         | 6   | 12   | 5     | 5                    | 50 | 5    | 2     | — |
| Fisk U                     | 9                    | 0  | 3    | —     | —                    | —  | —    | —     | — | Baton Rouge               | 1   | 3    | 1     | —                    | 15 | 5    | —     | — |
| Florida Atlantic U         | 9                    | 20 | 0    | —     | —                    | —  | —    | —     | — | Shreveport <sup>a</sup>   | 4   | 20   | 6     | 2                    | —  | 20   | 1     | — |
| Florida State U            | 2                    | 36 | 4    | 13    | —                    | —  | —    | —     | — | Louisville, U of          | 20  | 2    | 10    | 2                    | 40 | 2    | —     | — |
| Florida, U of              | 5                    | 99 | 4    | 16    | 51                   | 18 | 5    | —     | — | Lowell, U of              | 3   | 1    | —     | —                    | —  | —    | —     | — |
| Fordham U                  | 5                    | 9  | 10   | 6     | —                    | —  | —    | —     | — | Loyola C                  | 3   | 1    | —     | —                    | —  | —    | —     | — |
| Franklin and Marshall C    | 14                   | 17 | —    | —     | —                    | —  | —    | —     | — | Loyola Marymount U        | 12  | 0    | —     | —                    | —  | —    | —     | — |
| Furman U                   | 2                    | 14 | 1    | —     | —                    | —  | —    | —     | — | Loyola U                  | 0   | 1    | —     | —                    | —  | —    | —     | — |
| Geneva C                   | 3                    | 8  | —    | —     | —                    | —  | —    | —     | — | Loyola U of Chicago       | 10  | 14   | 2     | 3                    | —  | —    | —     | — |
| George Mason U             | 7                    | 2  | —    | —     | —                    | —  | —    | —     | — | Luther C                  | 3   | 9    | —     | —                    | —  | —    | —     | — |
| George Washington U        | 4                    | 15 | 1    | 1     | —                    | —  | —    | —     | — | Macalester C              | 3   | 13   | —     | —                    | —  | —    | —     | — |
| Georgetown U               | 25                   | 0  | 10   | 7     | —                    | —  | —    | —     | — | MacMurray C               | 3   | 0    | —     | —                    | —  | —    | —     | — |
| Georgia Institute of       | 35                   | 0  | 8    | 10    | 132                  | 7  | 0    | —     | — | Maine, U of               | 2   | 3    | 5     | 1                    | 31 | 4    | 0     | — |
| Technology                 | 2                    | 8  | 3    | —     | —                    | —  | —    | —     | — | Manhattan C <sup>c</sup>  | 30  | 3    | —     | —                    | 44 | 27   | —     | — |
| Georgia State U            | 4                    | 41 | 6    | 23    | —                    | —  | —    | —     | — | Manhattanville C          | 3   | 2    | —     | —                    | —  | —    | —     | — |
| Georgia, U of              | 2                    | 7  | —    | —     | —                    | —  | —    | —     | — | Mankato State U           | 3   | 9    | 0     | —                    | —  | —    | —     | — |
| Gettysburg C               | 2                    | 6  | —    | —     | —                    | —  | —    | —     | — | Marietta C                | 8   | 2    | —     | —                    | —  | —    | —     | — |
| Gonzaga U                  | 2                    | 6  | —    | —     | —                    | —  | —    | —     | — | Marist C                  | 0   | 3    | —     | —                    | —  | —    | —     | — |
| Goucher C                  | 4                    | 5  | —    | —     | —                    | —  | —    | —     | — | Marquette U               | 19  | 0    | 3     | 3                    | —  | —    | —     | — |
| Grand Valley State C       | 3                    | 9  | —    | —     | —                    | —  | —    | —     | — | Marshall U                | 8   | 16   | 5     | —                    | —  | —    | —     | — |
| Grinnell C                 | 7                    | 18 | —    | —     | —                    | —  | —    | —     | — | Maryland, U of            | 9   | 91   | 11    | 21                   | 51 | 15   | 3     | — |
| Gustavus Adolphus C        | 10                   | 11 | —    | —     | —                    | —  | —    | —     | — | Maryland Baltimore County | 17  | 0    | 2     | 0                    | —  | —    | —     | — |
| Hamilton C                 | 0                    | 7  | —    | —     | —                    | —  | —    | —     | — | Massachusetts             | 60  | 0    | 7     | 27                   | 86 | 44   | 8     | — |
| Hamline U                  | 5                    | 3  | —    | —     | —                    | —  | —    | —     | — | Massachusetts, U of       | 14  | 2    | 10    | 16                   | 51 | 4    | 7     | — |
| Hampden-Sydney C           | 5                    | 5  | —    | —     | —                    | —  | —    | —     | — | McMurry C                 | 2   | 2    | —     | —                    | —  | —    | —     | — |
| Hampton Institute          | 0                    | 1  | —    | —     | —                    | —  | —    | —     | — | McNeese State U           | 2   | 6    | 0     | —                    | —  | —    | —     | — |
| Hartford, U of             | 5                    | 2  | 0    | —     | —                    | —  | —    | —     | — | Memphis State U           | 6   | 8    | 0     | 0                    | —  | —    | —     | — |
| Hartwick C                 | 3                    | 3  | —    | —     | —                    | —  | —    | —     | — | Merrimack C               | 8   | 0    | —     | —                    | —  | —    | —     | — |
| Harvard U                  | —                    | 25 | 22   | 20    | —                    | —  | —    | —     | — | Metropolitan State C      | 9   | 5    | —     | —                    | —  | —    | —     | — |
| Harvey Mudd C              | 10                   | 0  | —    | —     | —                    | —  | —    | —     | — | Miami U                   | 19  | 60   | 5     | 3                    | —  | —    | —     | — |
| Haverford C                | 12                   | 6  | —    | —     | —                    | —  | —    | —     | — | Miami, U of               | 2   | 90   | 2     | 5                    | —  | —    | —     | — |
| Hawaii, U of               | 10                   | 5  | 5    | 4     | —                    | —  | —    | —     | — | Michigan State U          | 16  | 11   | 10    | 38                   | 72 | 8    | 0     | — |
| Hiram C                    | 1                    | 5  | —    | —     | —                    | —  | —    | —     | — |                           |     |      |       |                      |    |      |       |   |
| Hobart and William Smith C | 6                    | 13 | —    | —     | —                    | —  | —    | —     | — |                           |     |      |       |                      |    |      |       |   |
| Hofstra U                  | 1                    | 12 | —    | —     | —                    | —  | —    | —     | — |                           |     |      |       |                      |    |      |       |   |
| Hollins C                  | 1                    | 1  | —    | —     | —                    | —  | —    | —     | — |                           |     |      |       |                      |    |      |       |   |
| Holy Cross, C of The       | 3                    | 43 | 1    | —     | —                    | —  | —    | —     | — |                           |     |      |       |                      |    |      |       |   |
| Hope C                     | 14                   | 16 | —    | —     | —                    | —  | —    | —     | — |                           |     |      |       |                      |    |      |       |   |
| Houston, U of              | 10                   | 1  | 7    | 13    | 27                   | 10 | 4    | —     | — |                           |     |      |       |                      |    |      |       |   |
| Howard U                   | 4                    | 33 | 2    | 16    | 20                   | —  | —    | —     | — |                           |     |      |       |                      |    |      |       |   |

|                                           | CHEMISTRY            |     |      |       | CHEMICAL ENGINEERING |    |      |       |                              | CHEMISTRY            |    |      |       | CHEMICAL ENGINEERING |    |      |       |  |
|-------------------------------------------|----------------------|-----|------|-------|----------------------|----|------|-------|------------------------------|----------------------|----|------|-------|----------------------|----|------|-------|--|
|                                           | Bachelors, certified |     | M.S. | Ph.D. | B.S.                 |    | M.S. | Ph.D. |                              | Bachelors, certified |    | M.S. | Ph.D. | B.S.                 |    | M.S. | Ph.D. |  |
|                                           | Yes                  | No  |      |       |                      |    |      |       |                              | Yes                  | No |      |       |                      |    |      |       |  |
| Michigan Technological U                  | 12                   | 1   | 2    | 0     | 69                   | 5  | —    | —     | Oklahoma State U             | 3                    | 4  | 3    | 8     | 47                   | 22 | 3    | —     |  |
| Michigan, U of                            |                      |     |      |       |                      |    |      |       | Oklahoma, U of               | 12                   | 18 | 12   | 2     | 50                   | 6  | 7    | —     |  |
| Ann Arbor                                 | 61                   | 0   | 17   | 12    | 109                  | 28 | 4    | —     | Old Dominion U               | 5                    | 10 | 7    | —     | —                    | —  | —    | —     |  |
| Dearborn                                  | 13                   | 6   | —    | —     | —                    | —  | —    | —     | Oregon State U               | 12                   | 0  | 6    | 5     | 43                   | 9  | 2    | —     |  |
| Flint                                     | 1                    | 9   | —    | —     | —                    | —  | —    | —     | Oregon, U of                 | 8                    | 6  | 11   | 7     | —                    | —  | —    | —     |  |
| Middle Tennessee State U                  | 0                    | 41  | 1    | —     | —                    | —  | —    | —     | Pace U                       | 3                    | 1  | —    | —     | —                    | —  | —    | —     |  |
| Middlebury C                              | 0                    | 13  | 0    | —     | —                    | —  | —    | —     | Pacific Lutheran U           | 4                    | 12 | —    | —     | —                    | —  | —    | —     |  |
| Midwestern State U                        | 6                    | 1   | —    | —     | —                    | —  | —    | —     | Pacific, U of the            | 3                    | 12 | 3    | 0     | —                    | —  | —    | —     |  |
| Millersville State C                      | 7                    | 2   | —    | —     | —                    | —  | —    | —     | Pennsylvania State U         | 9                    | 13 | 13   | 22    | 112                  | 14 | 7    | —     |  |
| Millsaps C                                | 3                    | 22  | —    | —     | —                    | —  | —    | —     | Pennsylvania, U of           | 11                   | 12 | 4    | 12    | 36                   | 13 | 6    | —     |  |
| Minnesota, U of                           |                      |     |      |       |                      |    |      |       | Philadelphia C of            |                      |    |      |       |                      |    |      |       |  |
| Minneapolis                               | 38                   | 0   | 7    | 12    | (e)                  | —  | —    | —     | Pharmacy & Science           | 3                    | 0  | 2    | 0     | —                    | —  | —    | —     |  |
| Duluth                                    | 11                   | 5   | 2    | —     | —                    | —  | —    | —     | Philadelphia C of            |                      |    |      |       |                      |    |      |       |  |
| Mississippi C                             | 0                    | 11  | —    | —     | —                    | —  | —    | —     | Textiles & Science           | 4                    | 0  | —    | —     | —                    | —  | —    | —     |  |
| Mississippi State U                       | 7                    | 9   | 0    | 0     | 23                   | 1  | 0    | —     | Pittsburg State U            | 3                    | 0  | 4    | —     | —                    | —  | —    | —     |  |
| Mississippi, U of                         | 2                    | 21  | 0    | 0     | 14                   | 1  | 0    | —     | Pittsburgh, U of             | 52                   | 67 | 16   | 13    | 68                   | 13 | 2    | —     |  |
| Missouri, U of                            |                      |     |      |       |                      |    |      |       | Polytechnic Institute of     |                      |    |      |       |                      |    |      |       |  |
| Columbia                                  | 17                   | 18  | 12   | 2     | 62                   | 4  | 2    | —     | New York                     | 7                    | 0  | 7    | 8     | 31                   | 5  | 2    | —     |  |
| Kansas City                               | 11                   | 16  | 3    | 3     | —                    | —  | —    | —     | Pomona C                     | 5                    | 7  | —    | —     | —                    | —  | —    | —     |  |
| Rolla                                     | 10                   | 0   | 6    | 6     | 88                   | 4  | 3    | —     | Portland State U             | 9                    | 7  | 3    | —     | —                    | —  | —    | —     |  |
| St. Louis                                 | 10                   | 9   | 5    | 1     | —                    | —  | —    | —     | Pratt Institute <sup>b</sup> | —                    | —  | —    | —     | 8                    | —  | —    | —     |  |
| Monmouth C                                | 0                    | 4   | —    | —     | —                    | —  | —    | —     | Princeton U                  | 13                   | 8  | 10   | 22    | (e)                  | —  | —    | —     |  |
| Montana State U                           | 6                    | 0   | 3    | 2     | 47                   | 4  | 2    | —     | Providence C                 | 6                    | 9  | 1    | 1     | —                    | —  | —    | —     |  |
| Montana, U of                             | 3                    | 6   | 2    | 0     | —                    | —  | —    | —     | Puerto Rico, U of            |                      |    |      |       |                      |    |      |       |  |
| Montclair State C                         | 9                    | 27  | 5    | —     | —                    | —  | —    | —     | Mayaguez                     | 18                   | 10 | 6    | —     | 89                   | 0  | —    | —     |  |
| Moorhead State U                          | 4                    | 2   | 0    | —     | —                    | —  | —    | —     | Rio Piedras                  | 10                   | 55 | 3    | 3     | —                    | —  | —    | —     |  |
| Moravian C                                | 3                    | 5   | —    | —     | —                    | —  | —    | —     | Puget Sound, U of            | 9                    | 11 | 2    | —     | —                    | —  | —    | —     |  |
| Morehouse C <sup>d</sup>                  | 6                    | 4   | 12   | —     | —                    | —  | —    | —     | Purdue U                     | 25                   | 16 | 22   | 38    | 159                  | 10 | 2    | —     |  |
| Morgan State U                            | 3                    | 6   | —    | —     | —                    | —  | —    | —     | Purdue U, Calumet            | 8                    | 0  | —    | —     | —                    | —  | —    | —     |  |
| Mount Holyoke C                           | 0                    | 11  | 0    | 0     | —                    | —  | —    | —     | Randolph Macon Woman's C     | 0                    | 2  | —    | —     | —                    | —  | —    | —     |  |
| Mount Saint Vincent, C of <sup>c</sup>    | 3                    | 0   | —    | —     | —                    | —  | —    | —     | Redlands, U of               | 0                    | 3  | —    | —     | —                    | —  | —    | —     |  |
| Muhlenberg C                              | 4                    | 12  | —    | —     | —                    | —  | —    | —     | Reed C                       | 16                   | 4  | —    | —     | —                    | —  | —    | —     |  |
| Murray State U                            | 7                    | 16  | 5    | —     | —                    | —  | —    | —     | Regis C                      | 3                    | 5  | —    | —     | —                    | —  | —    | —     |  |
| Muskingum C                               | 2                    | 6   | —    | —     | —                    | —  | —    | —     | Rensselaer                   |                      |    |      |       |                      |    |      |       |  |
| Nebraska, U of                            |                      |     |      |       |                      |    |      |       | Polytechnic Institute        | 32                   | 0  | 7    | 7     | 97                   | 10 | 2    | —     |  |
| Lincoln                                   | 9                    | 9   | 9    | 15    | 14                   | 4  | —    | —     | Rhode Island, U of           | 6                    | 2  | 4    | 3     | 23                   | 3  | 0    | —     |  |
| Omaha                                     | 4                    | 7   | —    | —     | —                    | —  | —    | —     | Rice U                       | 6                    | 4  | 2    | 10    | —                    | 19 | 5    | —     |  |
| Nebraska Wesleyan U                       | 5                    | 7   | —    | —     | —                    | —  | —    | —     | Richmond, U of               | 2                    | 13 | 0    | —     | —                    | —  | —    | —     |  |
| Nevada, U of                              |                      |     |      |       |                      |    |      |       | Rider C                      | 4                    | 0  | —    | —     | —                    | —  | —    | —     |  |
| Las Vegas                                 | 4                    | 0   | —    | —     | —                    | —  | —    | —     | Ripon C                      | 5                    | 0  | —    | —     | —                    | —  | —    | —     |  |
| Reno                                      | 3                    | 3   | 2    | 1     | —                    | —  | —    | —     | Roanoke C                    | 1                    | 3  | —    | —     | —                    | —  | —    | —     |  |
| New Hampshire, U of                       | 2                    | 6   | 2    | 1     | 15                   | 1  | 0    | —     | Rochester Institute of Tech  | 5                    | 7  | 7    | —     | —                    | —  | —    | —     |  |
| New Jersey Institute of Tech <sup>b</sup> | —                    | —   | —    | —     | 102                  | 17 | 0    | —     | Rochester, U of              | 16                   | 13 | 10   | 13    | 25                   | 9  | 3    | —     |  |
| New Mexico Highlands U                    | 0                    | 2   | 2    | —     | —                    | —  | —    | —     | Rollins C                    | 1                    | 3  | —    | —     | —                    | —  | —    | —     |  |
| New Mexico Institute of                   |                      |     |      |       |                      |    |      |       | Roosevelt U                  | 7                    | 3  | 7    | —     | —                    | —  | —    | —     |  |
| Mining & Technology                       | 8                    | 0   | 4    | —     | —                    | —  | —    | —     | Rose-Hulman                  |                      |    |      |       |                      |    |      |       |  |
| New Mexico State U                        | 6                    | 9   | 10   | 3     | 27                   | 4  | —    | —     | Institute of Technology      | 4                    | 0  | —    | —     | (e)                  | —  | —    | —     |  |
| New Mexico, U of                          | 11                   | 11  | 7    | 10    | 27                   | 4  | 1    | —     | Russell Sage C               | 6                    | 2  | —    | —     | —                    | —  | —    | —     |  |
| New Orleans, U of                         | 5                    | 6   | 2    | 5     | —                    | —  | —    | —     | Rutgers U                    | —                    | —  | —    | —     | (e)                  | —  | —    | —     |  |
| New York U                                | 8                    | 23  | 12   | 3     | —                    | —  | —    | —     | Douglass C                   | 30                   | 0  | —    | —     | —                    | —  | —    | —     |  |
| North Alabama, U of                       | 11                   | 11  | —    | —     | —                    | —  | —    | —     | Rutgers C                    | 47                   | 0  | 13   | 11    | —                    | —  | —    | —     |  |
| North Carolina A&T State U                | 1                    | 0   | 2    | —     | —                    | —  | —    | —     | Newark C of Arts &           |                      |    |      |       |                      |    |      |       |  |
| North Carolina Central U                  | 0                    | 9   | 1    | —     | —                    | —  | —    | —     | Sciences                     | 17                   | 11 | 13   | 3     | —                    | —  | —    | —     |  |
| North Carolina State U                    | 24                   | 5   | 4    | 3     | 53                   | 10 | 4    | —     | Saginaw Valley State C       | 2                    | 8  | —    | —     | —                    | —  | —    | —     |  |
| North Carolina, U of                      |                      |     |      |       |                      |    |      |       | St. Anselm's C               | 2                    | 5  | —    | —     | —                    | —  | —    | —     |  |
| Chapel Hill                               | 39                   | 132 | 5    | 22    | —                    | —  | —    | —     | St. Cloud State U            | 3                    | 10 | —    | —     | —                    | —  | —    | —     |  |
| Charlotte                                 | 4                    | 9   | 1    | —     | —                    | —  | —    | —     | St. John Fisher C            | 10                   | 1  | —    | —     | —                    | —  | —    | —     |  |
| Greensboro                                | 13                   | 5   | 1    | —     | —                    | —  | —    | —     | St. John's U                 | 9                    | 1  | 7    | 2     | —                    | —  | —    | —     |  |
| Wilmington                                | 6                    | 11  | —    | —     | —                    | —  | —    | —     | St. Joseph C                 | 2                    | 2  | 6    | —     | —                    | —  | —    | —     |  |
| North Dakota State U                      | 7                    | 2   | 3    | 6     | —                    | —  | —    | —     | St. Joseph's U               | 5                    | 23 | 14   | —     | —                    | —  | —    | —     |  |
| North Dakota, U of                        | 3                    | 8   | 2    | 1     | 17                   | 5  | —    | —     | St. Lawrence U               | 12                   | 21 | —    | —     | —                    | —  | —    | —     |  |
| North Texas State U                       | 5                    | 10  | 2    | 1     | —                    | —  | —    | —     | St. Louis U                  | 6                    | 35 | 4    | 2     | —                    | —  | —    | —     |  |
| Northeast Louisiana U                     | 5                    | 0   | 5    | —     | —                    | —  | —    | —     | St. Mary's C <sup>a</sup>    | 0                    | 10 | —    | —     | —                    | —  | —    | —     |  |
| Northeastern U                            | 6                    | 0   | 6    | 7     | (e)                  | —  | —    | —     | St. Olaf C                   | 10                   | 32 | —    | —     | —                    | —  | —    | —     |  |
| Northern Arizona U                        | 10                   | 47  | 0    | —     | —                    | —  | —    | —     | St. Peter's C                | 0                    | 1  | —    | —     | —                    | —  | —    | —     |  |
| Northern Colorado, U of                   | 5                    | 5   | 0    | —     | —                    | —  | —    | —     | St. Thomas, C of             | 3                    | 11 | —    | —     | —                    | —  | —    | —     |  |
| Northern Illinois U                       | 19                   | 17  | 3    | 3     | —                    | —  | —    | —     | Sam Houston State U          | 9                    | 3  | 3    | —     | —                    | —  | —    | —     |  |
| Northern Iowa, U of                       | 2                    | 4   | 2    | —     | —                    | —  | —    | —     | San Diego State U            | 25                   | 0  | 6    | 0     | —                    | —  | —    | —     |  |
| Northern Michigan U                       | 1                    | 11  | 1    | —     | —                    | —  | —    | —     | San Francisco State U        | 18                   | 30 | 4    | —     | —                    | —  | —    | —     |  |
| Northwest Missouri State U                | 2                    | 1   | —    | —     | —                    | —  | —    | —     | San Francisco, U of          | 8                    | 3  | 2    | —     | —                    | —  | —    | —     |  |
| Northwestern State                        |                      |     |      |       |                      |    |      |       | San Jose State U             | 21                   | 19 | 8    | —     | 18                   | 7  | —    | —     |  |
| U of Louisiana                            | 1                    | 2   | 0    | —     | —                    | —  | —    | —     | Santa Clara, U of            | 10                   | 10 | —    | —     | —                    | —  | —    | —     |  |
| Northwestern U                            | 11                   | 18  | 29   | 35    | 52                   | 15 | 6    | —     | Scranton, U of               | 20                   | 17 | 9    | —     | —                    | —  | —    | —     |  |
| Norwich U                                 | 0                    | 0   | —    | —     | —                    | —  | —    | —     | Seattle U                    | 1                    | 3  | —    | —     | —                    | —  | —    | —     |  |
| Notre Dame, U of                          | 6                    | 18  | 4    | 3     | 51                   | 4  | 5    | —     | Seton Hall U                 | 9                    | 7  | 9    | 2     | —                    | —  | —    | —     |  |
| Oakland U                                 | 17                   | 8   | 2    | —     | —                    | —  | —    | —     | Shippensburg State C         | 8                    | 4  | 3    | —     | —                    | —  | —    | —     |  |
| Oberlin C                                 | 0                    | 31  | 0    | —     | —                    | —  | —    | —     | Siena C                      | 9                    | 0  | —    | —     | —                    | —  | —    | —     |  |
| Occidental C                              | 2                    | 18  | —    | —     | —                    | —  | —    | —     | Simmons C                    | 3                    | 4  | —    | —     | —                    | —  | —    | —     |  |
| Ohio Northern U                           | 3                    | 2   | —    | —     | —                    | —  | —    | —     | Skidmore C                   | 2                    | 13 | —    | —     | —                    | —  | —    | —     |  |
| Ohio State U                              | 11                   | 3   | 24   | 29    | 63                   | 6  | 2    | —     | Slippery Rock State C        | 3                    | 1  | —    | —     | —                    | —  | —    | —     |  |
| Ohio U                                    | 8                    | 9   | 1    | 7     | 21                   | 2  | 1    | —     | Smith C                      | 2                    | 5  | 1    | 0     | —                    | —  | —    | —     |  |
| Ohio Wesleyan U                           | 3                    | 5   | —    | —     | —                    | —  | —    | —     | Sonoma State C               | 0                    | 10 | —    | —     | —                    | —  | —    | —     |  |

|                                           | CHEMISTRY            |    |      |       | CHEMICAL ENGINEERING |    |      |                                          | CHEMISTRY            |    |      |       | CHEMICAL ENGINEERING |    |      |       |  |  |  |
|-------------------------------------------|----------------------|----|------|-------|----------------------|----|------|------------------------------------------|----------------------|----|------|-------|----------------------|----|------|-------|--|--|--|
|                                           | Bachelors, certified |    | M.S. | Ph.D. | B.S.                 |    | M.S. | Ph.D.                                    | Bachelors, certified |    | M.S. | Ph.D. | B.S.                 |    | M.S. | Ph.D. |  |  |  |
|                                           | Yes                  | No |      |       |                      |    |      |                                          | Yes                  | No |      |       |                      |    |      |       |  |  |  |
| South Carolina, U of                      | 9                    | 22 | 7    | 13    | 21                   | 3  | 1    | Union C                                  | 3                    | 18 | 1    | —     | —                    | —  | —    | —     |  |  |  |
| South Dakota School of Mines & Technology | 2                    | 1  | 8    | —     | 20                   | 1  | —    | U.S. Air Force Academy                   | 12                   | 0  | —    | —     | —                    | —  | —    | —     |  |  |  |
| South Dakota State U                      | 3                    | 19 | 3    | —     | —                    | —  | —    | U.S. Naval Academy                       | 20                   | 0  | —    | —     | —                    | —  | —    | —     |  |  |  |
| South Dakota, U of                        | 7                    | 23 | 6    | —     | —                    | —  | —    | Ursinus C                                | 10                   | 12 | —    | —     | —                    | —  | —    | —     |  |  |  |
| South Florida, U of                       | 23                   | 85 | 1    | 3     | 16                   | 2  | 0    | Utah State U                             | 8                    | 0  | 2    | 3     | —                    | —  | —    | —     |  |  |  |
| Southeast Missouri State U                | 0                    | 1  | —    | —     | —                    | —  | —    | Utah, U of                               | 4                    | 38 | 8    | 10    | 29                   | 13 | 1    | —     |  |  |  |
| Southeastern                              |                      |    |      |       |                      |    |      | Valparaiso U                             | 4                    | 25 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Massachusetts U                           | 3                    | 8  | 2    | —     | —                    | —  | —    | Vanderbilt U                             | 3                    | 41 | 4    | 5     | 22                   | 2  | 1    | —     |  |  |  |
| Southern California, U of                 | 10                   | 5  | 13   | 6     | (e)                  | —  | —    | Vassar C                                 | 1                    | 2  | 1    | —     | —                    | —  | —    | —     |  |  |  |
| Southern Illinois U                       |                      |    |      |       |                      |    |      | Vermont, U of                            | 13                   | 0  | 0    | 5     | —                    | —  | —    | —     |  |  |  |
| Carbondale                                | 3                    | 15 | 1    | 7     | —                    | —  | —    | Villanova U                              | 8                    | 0  | 3    | 1     | 25                   | 8  | —    | —     |  |  |  |
| Edwardsville                              | 3                    | 13 | 6    | —     | —                    | —  | —    | Virginia Commonwealth U                  | 3                    | 20 | 5    | 1     | —                    | —  | —    | —     |  |  |  |
| Southern Methodist U                      | 7                    | 11 | 1    | —     | —                    | —  | —    | Virginia Military Institute              | 15                   | 0  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Southern Mississippi, U of                | 3                    | 8  | 5    | 1     | —                    | —  | —    | Virginia Polytechnic Institute & State U | 18                   | 12 | 7    | 9     | 58                   | 8  | 1    | —     |  |  |  |
| Southern Oregon State C                   | 2                    | 0  | —    | —     | —                    | —  | —    | Virginia, U of                           | 10                   | 52 | 1    | 4     | 39                   | 27 | 1    | —     |  |  |  |
| Southern U & A&M C                        | 3                    | 0  | 1    | —     | —                    | —  | —    | Wabash C                                 | 9                    | 11 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Southwest Missouri State U                | 1                    | 17 | —    | —     | —                    | —  | —    | Wagner C                                 | 9                    | 11 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Southwest State U                         | 2                    | 3  | —    | —     | —                    | —  | —    | Wake Forest U                            | 0                    | 38 | 3    | 0     | —                    | —  | —    | —     |  |  |  |
| Southwest Texas State U                   | 12                   | 2  | 4    | —     | —                    | —  | —    | Washburn U of Topeka                     | 1                    | 5  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Southwestern at Memphis                   | 3                    | 2  | —    | —     | —                    | —  | —    | Washington C                             | 6                    | 0  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Southwestern Louisiana, U of              | 4                    | 13 | 0    | —     | 16                   | —  | —    | Washington and Jefferson C               | 4                    | 26 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Southwestern                              |                      |    |      |       |                      |    |      | Washington and Lee U                     | 0                    | 5  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Oklahoma State U                          | 7                    | 14 | —    | —     | —                    | —  | —    | Washington State U                       | 13                   | 9  | 2    | 8     | 32                   | 6  | 3    | —     |  |  |  |
| Stanford U                                | 19                   | 6  | 2    | 25    | 19                   | 18 | 6    | Washington U                             | 15                   | 1  | 15   | 2     | 63                   | 7  | 4    | —     |  |  |  |
| State U of New York                       |                      |    |      |       |                      |    |      | Washington, U of                         | 39                   | 20 | 15   | 9     | 86                   | 17 | 3    | —     |  |  |  |
| Albany                                    | 39                   | 0  | 2    | 3     | —                    | —  | —    | Wayne State U                            | 15                   | 38 | 11   | 13    | (e)                  | —  | —    | —     |  |  |  |
| Binghamton                                | 0                    | 43 | 4    | 4     | —                    | —  | —    | Waynesburg C                             | 4                    | 1  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Buffalo                                   | 16                   | 27 | 8    | 13    | 55                   | 7  | 1    | Weber State C                            | 4                    | 3  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Stony Brook                               | 23                   | 7  | 8    | 15    | —                    | —  | —    | Wellesley C                              | 1                    | 26 | —    | —     | —                    | —  | —    | —     |  |  |  |
| C at Brockport                            | 2                    | 11 | —    | —     | —                    | —  | —    | Wells C                                  | 1                    | 0  | —    | —     | —                    | —  | —    | —     |  |  |  |
| C at Buffalo                              | 9                    | 9  | 0    | —     | —                    | —  | —    | Wesleyan U                               | 5                    | 9  | 0    | 4     | —                    | —  | —    | —     |  |  |  |
| C at Cortland                             | 8                    | 9  | —    | —     | —                    | —  | —    | West Chester State C                     | 6                    | 13 | 1    | —     | —                    | —  | —    | —     |  |  |  |
| C at Fredonia                             | 13                   | 1  | 0    | —     | —                    | —  | —    | West Florida, U of                       | 9                    | 1  | —    | —     | —                    | —  | —    | —     |  |  |  |
| C at Geneseo                              | 3                    | 5  | 1    | —     | —                    | —  | —    | West Texas State U                       | 1                    | 8  | 5    | —     | —                    | —  | —    | —     |  |  |  |
| C at New Paltz                            | 7                    | 0  | 2    | —     | —                    | —  | —    | West Virginia Institute of Technology    | 1                    | 0  | —    | —     | (e)                  | —  | —    | —     |  |  |  |
| C at Oneonta                              | 3                    | 20 | 0    | —     | —                    | —  | —    | West Virginia State C                    | 3                    | 4  | —    | —     | —                    | —  | —    | —     |  |  |  |
| C at Oswego                               | 20                   | 8  | 4    | —     | —                    | —  | —    | West Virginia U                          | 9                    | 36 | 5    | 3     | 37                   | 11 | 5    | —     |  |  |  |
| C at Plattsburgh                          | 3                    | 11 | 0    | —     | —                    | —  | —    | Western Illinois U                       | 3                    | 0  | 1    | —     | —                    | —  | —    | —     |  |  |  |
| C at Potsdam                              | 4                    | 22 | —    | —     | —                    | —  | —    | Western Kentucky U                       | 6                    | 10 | 6    | —     | —                    | —  | —    | —     |  |  |  |
| Stephen F. Austin State U                 | 3                    | 4  | 2    | —     | —                    | —  | —    | Western Maryland C                       | 2                    | 4  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Stetson U                                 | 3                    | 2  | —    | —     | —                    | —  | —    | Western Michigan U                       | 6                    | 24 | 7    | 1     | —                    | —  | —    | —     |  |  |  |
| Stevens Institute of Technology           | 4                    | 12 | 15   | 1     | —                    | —  | —    | Western New England C                    | 0                    | 1  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Suffolk U                                 | 3                    | 6  | —    | —     | —                    | —  | —    | Western Washington U                     | 6                    | 11 | 4    | —     | —                    | —  | —    | —     |  |  |  |
| Susquehanna U                             | 3                    | 1  | —    | —     | —                    | —  | —    | Westminster C                            | 0                    | 6  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Swarthmore C                              | 4                    | 6  | —    | —     | —                    | —  | —    | Wheaton C (Illinois)                     | 1                    | 12 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Syracuse U                                | 7                    | 7  | 2    | 4     | 21                   | 2  | 1    | Wheaton C (Massachusetts)                | 1                    | 11 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Temple U                                  | 9                    | 12 | 2    | 2     | —                    | —  | —    | Wheeling C                               | 1                    | 3  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Tennessee Tech U                          | 4                    | 17 | 1    | —     | 14                   | 11 | —    | Whitman C                                | 4                    | 10 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Tennessee, U of                           |                      |    |      |       |                      |    |      | Whittier C                               | 0                    | 6  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Knoxville                                 | 2                    | 20 | 6    | 13    | 35                   | 6  | 1    | Wichita State U                          | 5                    | 3  | 4    | 0     | —                    | —  | —    | —     |  |  |  |
| Chattanooga                               | 13                   | 19 | —    | —     | —                    | —  | —    | Widener C                                | 6                    | 4  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Martin                                    | 3                    | 14 | —    | —     | —                    | —  | —    | Wilkes C                                 | 6                    | 3  | 0    | —     | —                    | —  | —    | —     |  |  |  |
| Texas A&I U                               | 2                    | 0  | 1    | —     | (e)                  | —  | —    | Willamette U                             | 1                    | 8  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Texas A&M U                               | 12                   | 9  | 6    | 21    | 110                  | 5  | 2    | William and Mary, C of                   | 6                    | 24 | 0    | —     | —                    | —  | —    | —     |  |  |  |
| Texas Christian U                         | 6                    | 4  | 3    | 2     | —                    | —  | —    | Williams C                               | 6                    | 26 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Texas Southern U                          | 20                   | 0  | 10   | —     | —                    | —  | —    | Wisconsin, U of                          |                      |    |      |       |                      |    |      |       |  |  |  |
| Texas Tech U                              | 7                    | 10 | 7    | 5     | (e)                  | —  | —    | Eau Claire                               | 4                    | 21 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Texas, U of                               |                      |    |      |       |                      |    |      | Green Bay                                | 0                    | 6  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Arlington                                 | 15                   | 16 | 6    | —     | —                    | —  | —    | La Crosse                                | 2                    | 22 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Austin                                    | 56                   | 0  | 6    | 16    | 82                   | 15 | 5    | Madison                                  | 14                   | 9  | 12   | 49    | 88                   | 9  | 11   | —     |  |  |  |
| Dallas                                    | 2                    | 2  | 1    | —     | —                    | —  | —    | Milwaukee                                | 3                    | 24 | 8    | 9     | —                    | —  | —    | —     |  |  |  |
| El Paso                                   | 11                   | 1  | 10   | —     | —                    | —  | —    | Oshkosh                                  | 6                    | 3  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Texas Woman's U                           | 1                    | 4  | 1    | 3     | —                    | —  | —    | Parkside                                 | 16                   | 6  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Thiel C                                   | 4                    | 12 | —    | —     | —                    | —  | —    | Platteville                              | 1                    | 3  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Thomas More C                             | 3                    | 5  | —    | —     | —                    | —  | —    | River Falls                              | 3                    | 8  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Toledo, U of                              | 1                    | 14 | 1    | 1     | 23                   | 3  | 1    | Stevens Point                            | 1                    | 6  | —    | 0     | —                    | —  | —    | —     |  |  |  |
| Towson State U                            | 9                    | 8  | —    | —     | —                    | —  | —    | Superior                                 | 1                    | 3  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Trenton State C <sup>a</sup>              | 9                    | 3  | —    | —     | —                    | —  | —    | Wittenberg U                             | 9                    | 11 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Trinity C                                 | 9                    | 5  | 0    | —     | —                    | —  | —    | Wooster, C of                            | 4                    | 29 | —    | —     | —                    | —  | —    | —     |  |  |  |
| Trinity U                                 | 1                    | 2  | 0    | —     | —                    | —  | —    | Worcester Polytechnic Institute          | 0                    | 13 | 1    | 0     | 41                   | 5  | 2    | —     |  |  |  |
| Tri-State U <sup>b</sup>                  | (a)                  | —  | —    | —     | —                    | —  | —    | Wright State U                           | 22                   | 19 | 16   | —     | —                    | —  | —    | —     |  |  |  |
| Tufts U                                   | 0                    | 48 | 1    | 1     | 33                   | 2  | 0    | Xavier U (Ohio)                          | 7                    | 9  | 2    | —     | —                    | —  | —    | —     |  |  |  |
| Tulane U of Louisiana                     | 0                    | 28 | 3    | 2     | (e)                  | —  | —    | Xavier U of Louisiana                    | 1                    | 8  | —    | —     | —                    | —  | —    | —     |  |  |  |
| Tulsa, U of                               | 4                    | 0  | —    | —     | 32                   | 12 | 0    | Yale U                                   | 23                   | 6  | 36   | 11    | —                    | —  | —    | —     |  |  |  |
| Tuskegee Institute                        | 1                    | 1  | 2    | —     | —                    | —  | —    | Youngstown State U                       | 6                    | 8  | 4    | —     | 15                   | —  | —    | —     |  |  |  |
| TOTALS                                    |                      |    |      |       |                      |    |      | 4424 6027 1716 1532 4977 951 237         |                      |    |      |       |                      |    |      |       |  |  |  |

<sup>a</sup> Added in 1979. <sup>b</sup> Listed on basis of accreditation by AICHE-ECPD. <sup>c</sup> The chemistry programs at Mount Saint Vincent College and Manhattan College are integrated into a combined department with all instruction in chemistry located at Manhattan College. <sup>d</sup> Master's degrees

given by Atlanta University. <sup>e</sup> Data not submitted. Note: For brevity, "B.S." and "M.S." are used to denote all bachelor's and master's degrees, respectively, in each column.